Studies on Dehydration of Figs

reduction in yeast count achieved is considered advantage for this type of drying

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The studies covered by this report were conducted by C. N. Chari and C. P. Natarajan, graduate students in the Division of Food Technology, under the direction of Dr. E. M. Mrak.

Fumigation of figs after picking kills insects and insect eggs present but as used in commercial practice does not free the fruit of living yeasts, molds and bacteria.

Microbial spoilage frequently occurs in figs while maturing on the trees and sometimes while drying on trays in the field. Spoilage during drying is more apt to occur in the cooler northern fig districts or during periods when the weather is unfavorable. There is little information available relative to the microbial changes occurring during drying.

Interest Increasing

During the past few years there has been an increased interest in the use of dehydration rather than sun-drying as a means of curing figs.

This is particularly true in the fig producing areas north of Madera in the San Joaquin Valley because of more unfavorable drying weather. This has given rise to the question of what effects dehydration has on the microbial population in figs.

It has been observed that there are no living yeasts or molds present on prunes at the end of commercial dehydration, even though initial dipping and washing procedures do not remove them.

In sun-drying, the yeasts present on fresh prunes are not killed, and may temporarily increase during the process. Prune dehydration, however, is quite different from that used for figs in that a much higher temperature and longer period of time are used. Likewise in the case of sun-drying prunes, a much longer period of time is required than for sun-drying figs.

Tests Made

During the 1947 season a series of experiments was conducted to follow the temperature and microbial population changes in the fruit during dehydration.

Microbial changes were also followed during drying in the sun. The drying tests were made in a small laboratory dehydrater operating at the desired temperature, and with an air flow of about 600 linear feet per minute. Sun-drying was done under unfavorable conditions on small wooden trays in the direct sun.

Calimyrna figs produced in the Fresno area of the San Joaquin Valley and harvested under commercial conditions were used in all tests.

Temperature changes in the flesh of the fruit were followed during dehydration by use of small copper-constantin thermocouples, and a potentiometer. The thermocouples were inserted in the flesh of the fig, at various points, or left exposed in the air stream of the dehydrater.

Dehydration tests were conducted at 130° F and 140° F because these are the temperature limits used in commercial operation. Drying at 130° F is quite slow, where as drying at 140° F introduces the danger of causing discoloration or case hardening, especially if the fruit is permitted to remain in the dehydrater too long or if it is too dry when introduced into the dehydrater.

Yeast Counts

The yeast and mold populations in the figs were followed during drying. Only yeast counts were made periodically during drying because the figs used in the tests showed high initial counts of yeasts, but very low ones of mold. Changes in bacterial populations were not followed because they are not important factors in the rapid spoilage that occurs during drying.

Yeast counts were made as follows: 20 figs were halved with a sterile knife. Twenty of the fig halves were then dropped into a jar containing 250 ml. of sterile water and allowed to stand one-half hour. Then the jar was shaken in a machine for one to two minutes. Counts were made after incubating 5% wort agar pour plates—with and without 0.25% of added sodium proprionate—with appropriate dilutions of water taken from the shaken jars. Proprionate was added to half the plates in order to minimize the growth of mold. This was not necessary since mold contamination of the fruit was so slight. Yeast colonies were counted after 48 hours of incubation and are reported as the number of yeasts per 10 figs.

It is apparent that the yeast population increased greatly during sun-drying under unfavorable weather conditions. During the first few days the yeast count increased considerably but declined somewhat as the fruit became dry. When the sun-dried fruit was subjected to dehydration at 130° F for a period of four hours the yeast count dropped from 3.5×10^8 to 1.3×10^7.

During dehydration, on the other hand, the decrease in yeast count was quite rapid after the first two hours in the dehydrater. During the intial two hours of drying there was a slight increase in yeast count. During this period the temperature in the fruit was between 60° F and 110° F most of the time so the yeast had some opportunity to multiply. The rapid decrease after the first two hours of dehydration was caused by the rapid rise in temperature of the fruit.

Observations

Figs approach the temperature of the surrounding air much more rapidly than prunes because of the peculiar structure of the former. The opening at the end of the fruit facilitates the movement of air in and out of the hollow interior.

Drying at 140° F resulted in a much greater and more rapid decrease in yeast count than drying at 130° F.

It is surprising to note, that even after drying at 130° F for 10 hours or 140° F for eight hours and reducing the moisture content to less than 20% an appreciable number of viable yeasts remained in the fruit. This is in contrast to prunes which when removed from the dehydrater are free of viable yeasts and molds. In the latter the contamination is practically all on the surface and drying is at 165° F for 18 to 24 hours.

In spite of the failure to sterilize figs during dehydration the great reduction in yeast count is a strong argument in favor of this type of drying for the fig.

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